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**G5R** RAC

(56) Documents Cited
**GB 2280332 A** **EP 0223529 A2** **US 5307326 A**
**US 4034164 A** **US 3978524 A** **US 3946156 A**

(58) Field of Search
UK CL (Edition P ) **G5R RAC RAD RGA , H4J JA JGX JL**
INT CL[6] **G11B 23/04 31/00 , H04B 1/38 , H04M 1/00 , H04R 5/027 5/04**
**ONLINE: WPI, JAPIO**

(54) Abstract Title
**Adapter receivable within a cassette player having external microphone.**

(57) An adapter 301 is receivable within a cassette player 304 mounted within a motor vehicle. The cassette player is configured to transmit audio signals to loudspeakers 106, 107 and a microphone 306 is arranged to receive vocalisations from vehicle occupants and to supply audio signals to the amplifier. The operation components are arranged to detect conditions to the effect that the adapter has been received within a cassette player and to activate the amplifier in response to this detection.

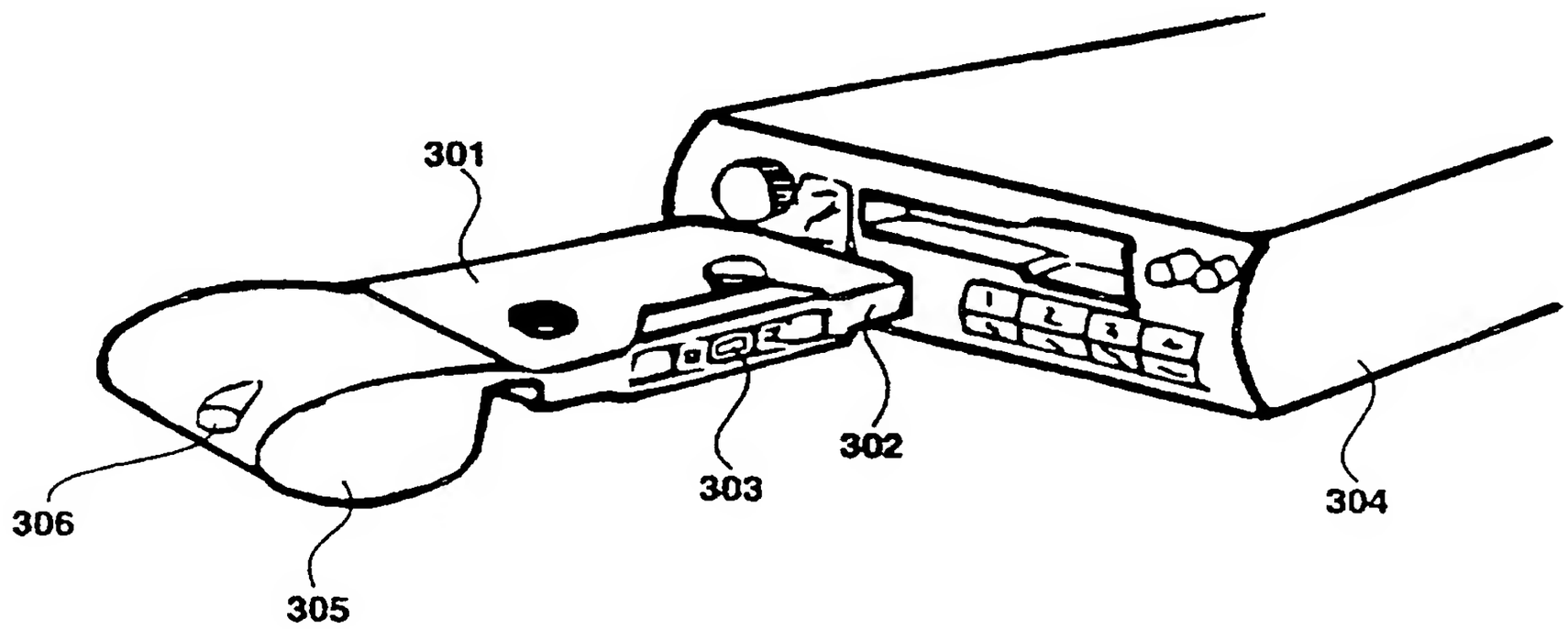



*Figure 3*



GB 2 341 512 A

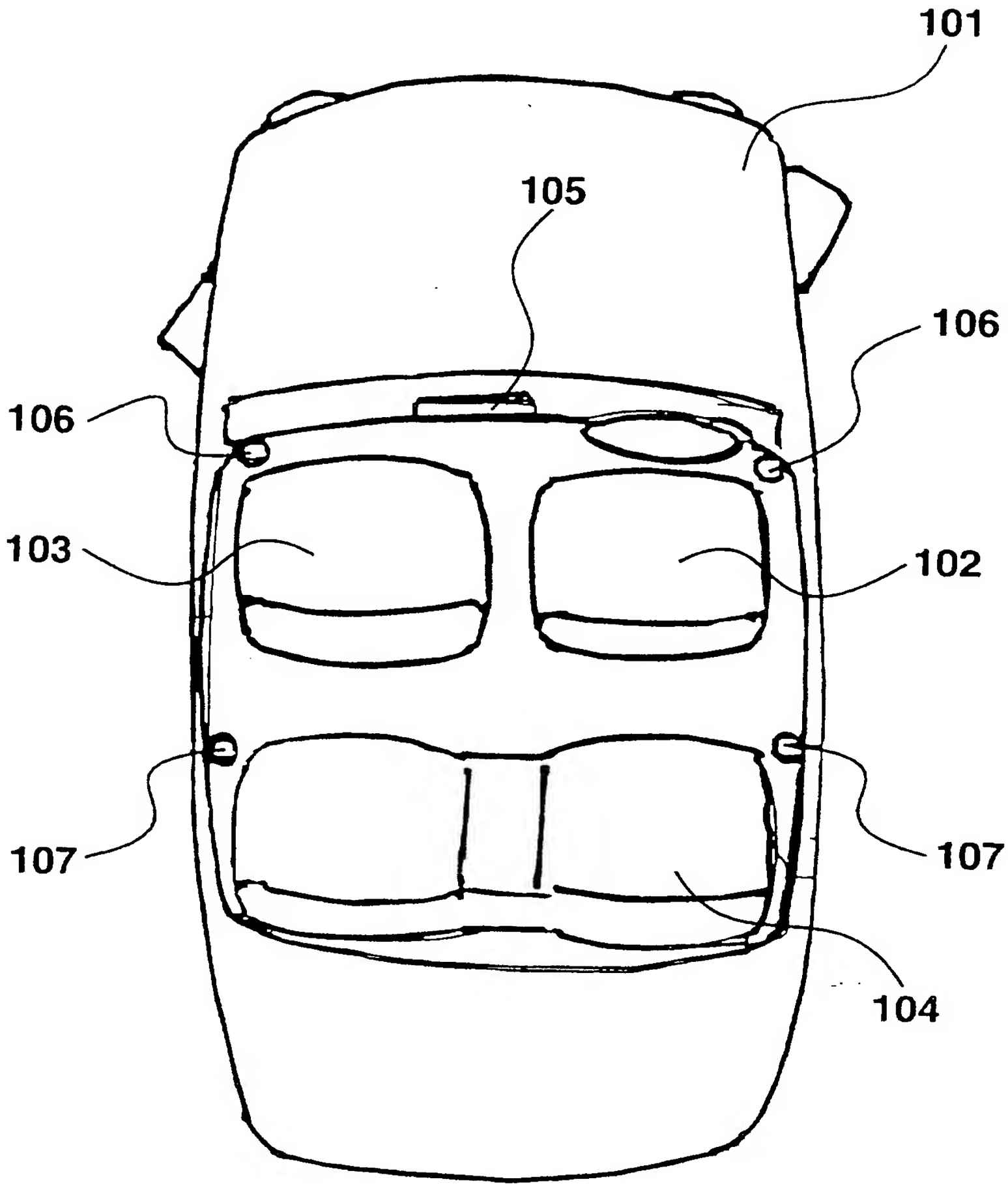



*Figure 1*

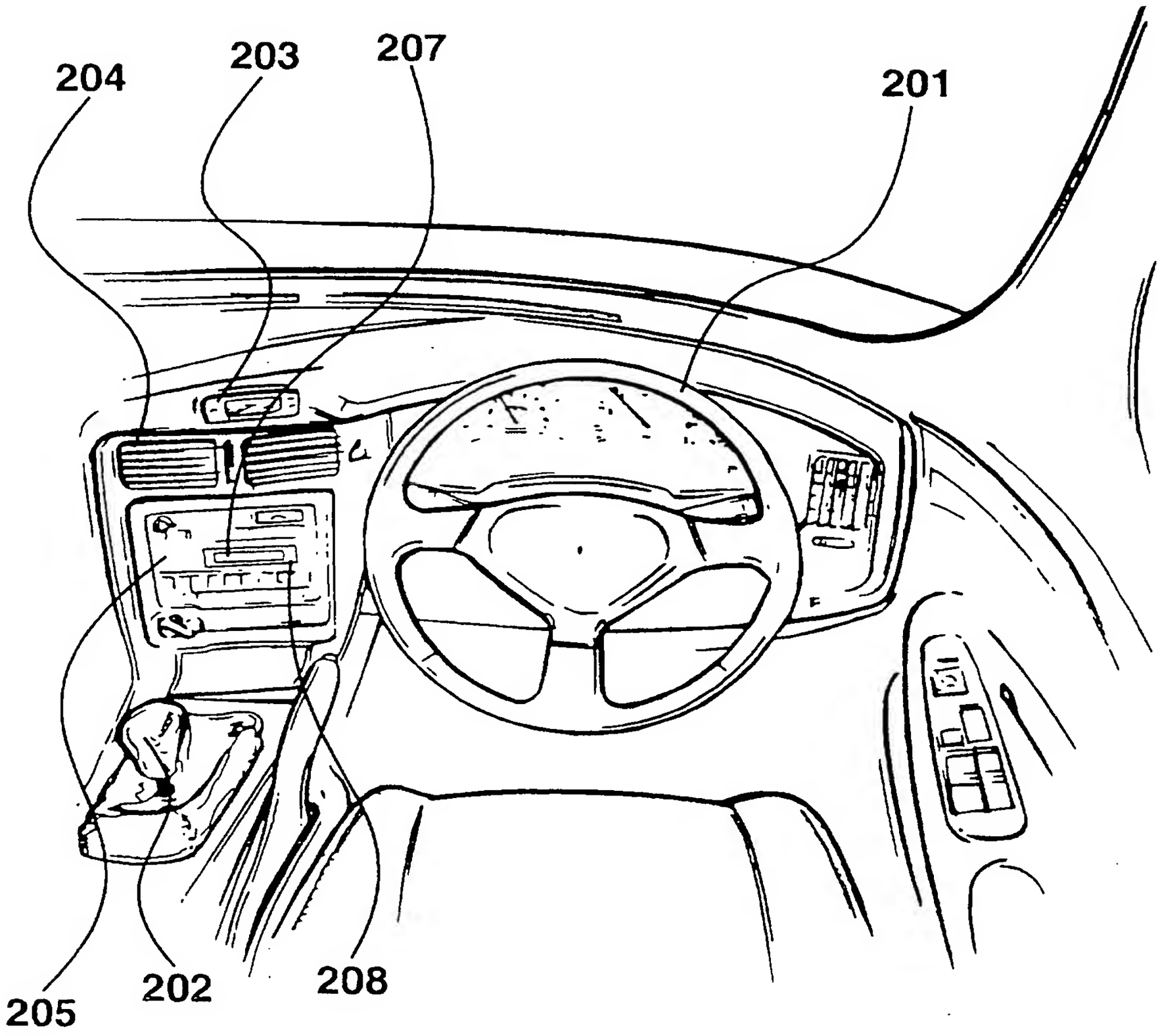



Figure 2

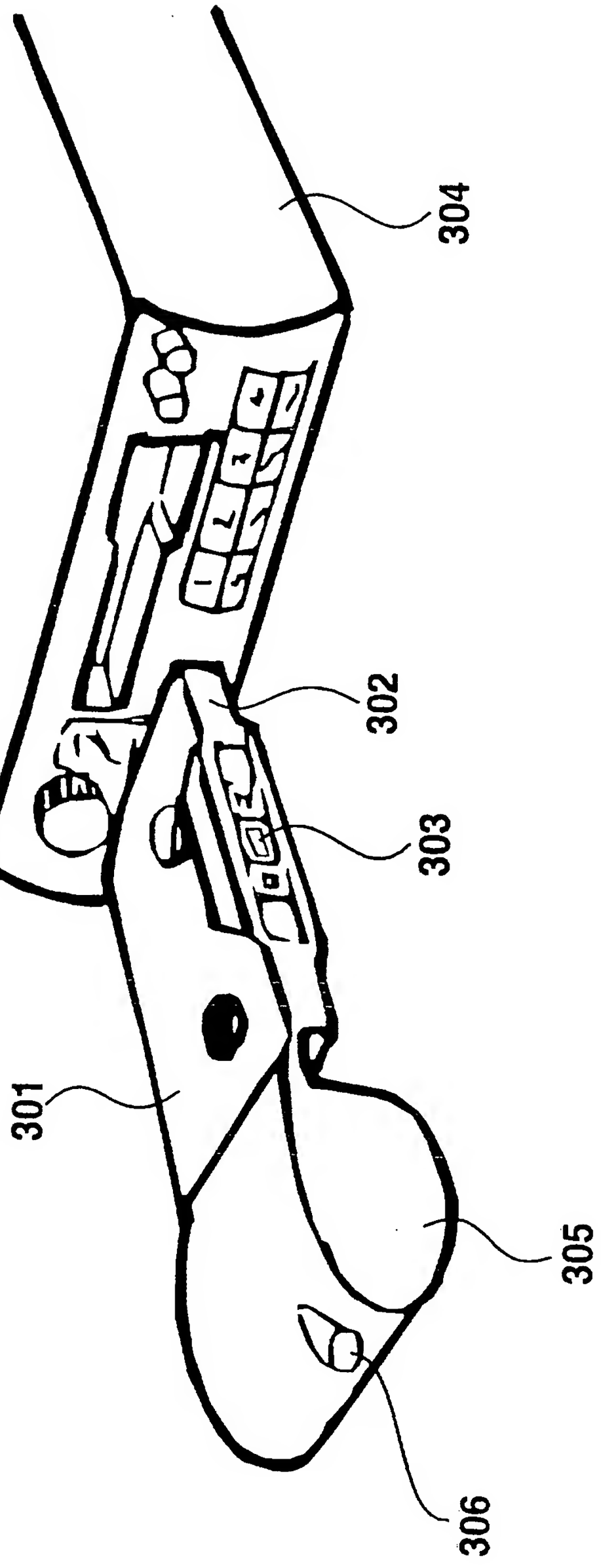



Figure 3

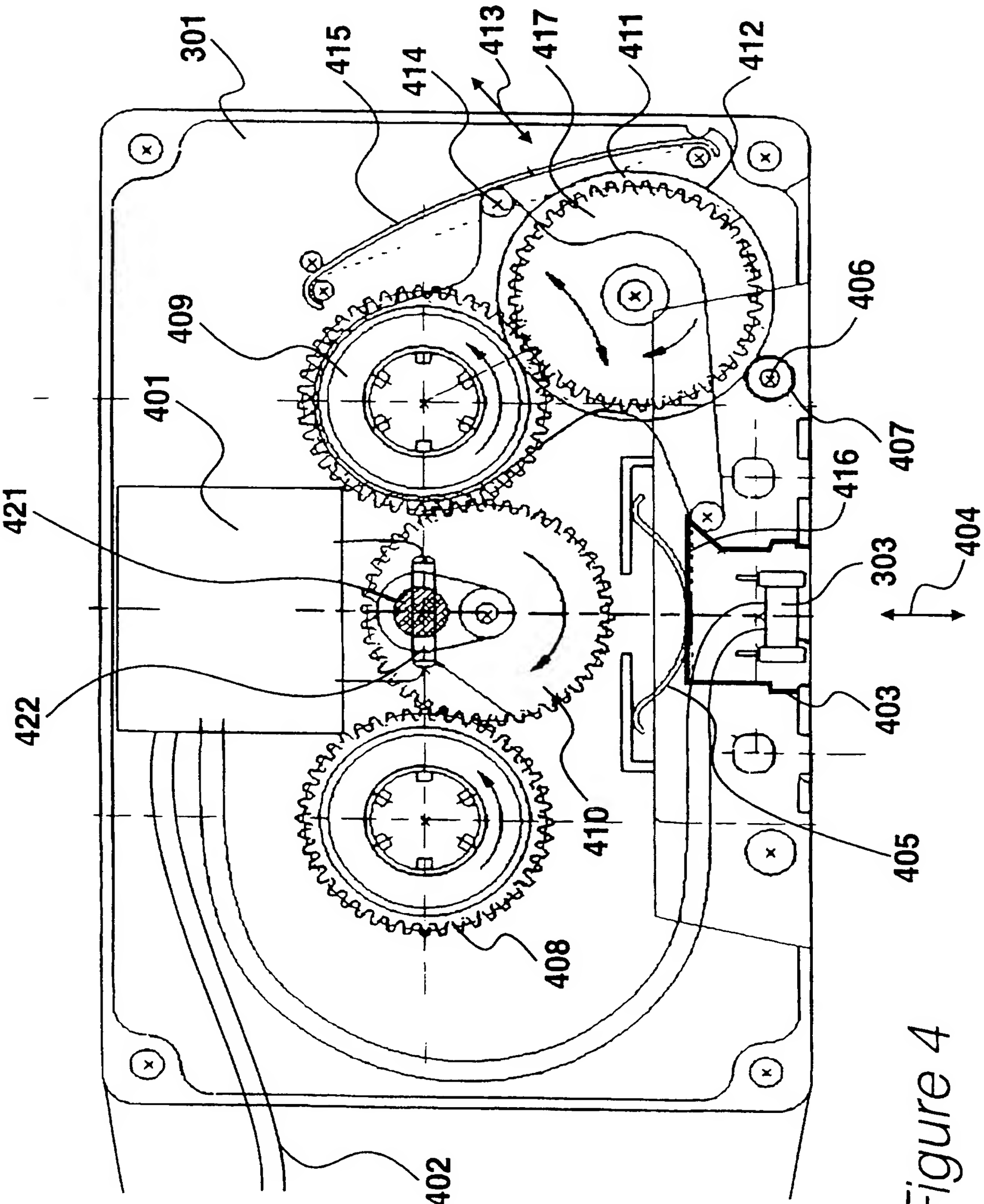
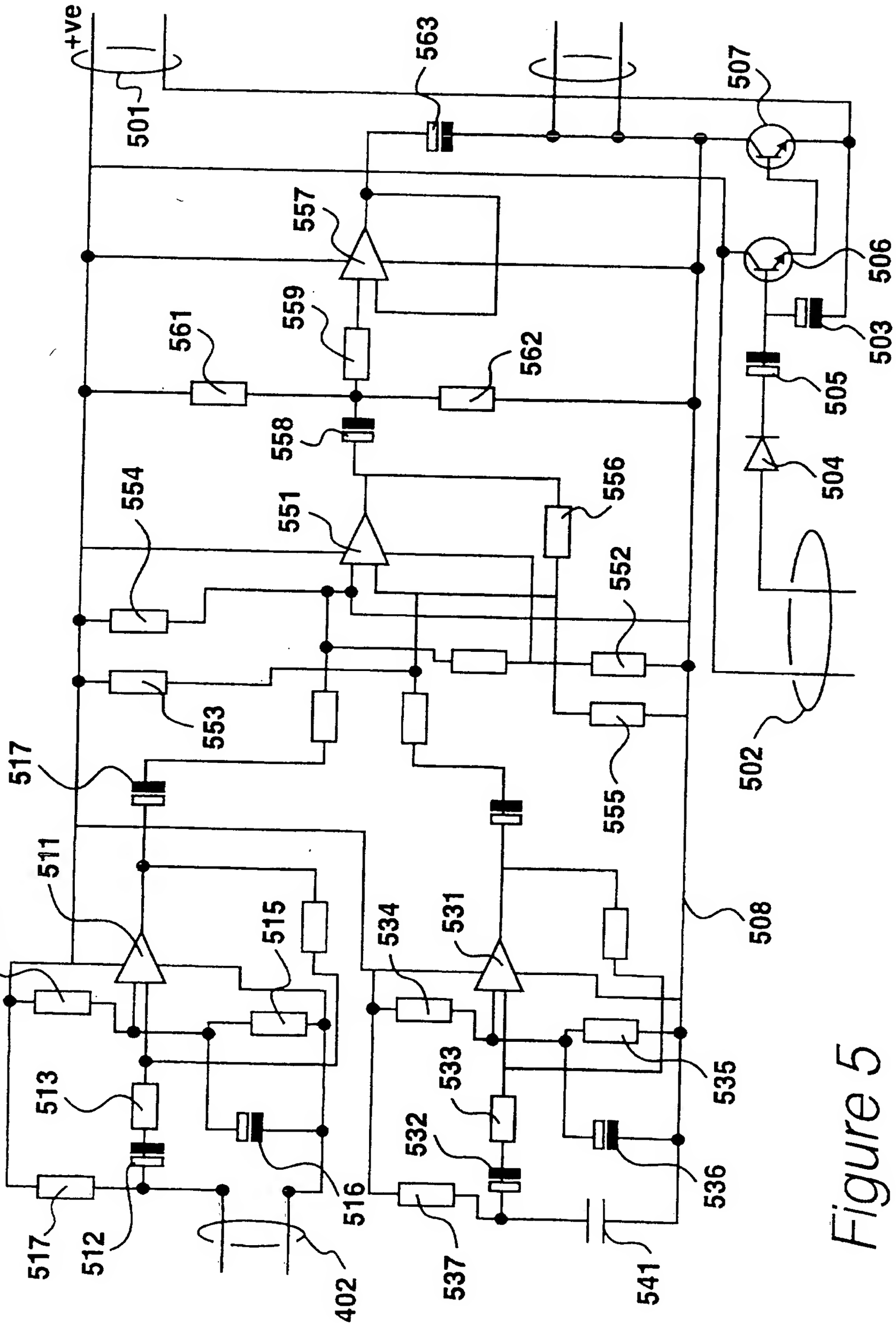

301
415
414
413
417
411
412
409
401
406
407
421
416
404
303
422
410
403
405
408
402

Figure 4


+ve
501
563
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506
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502
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402
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531
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532
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537
541
508

Figure 5

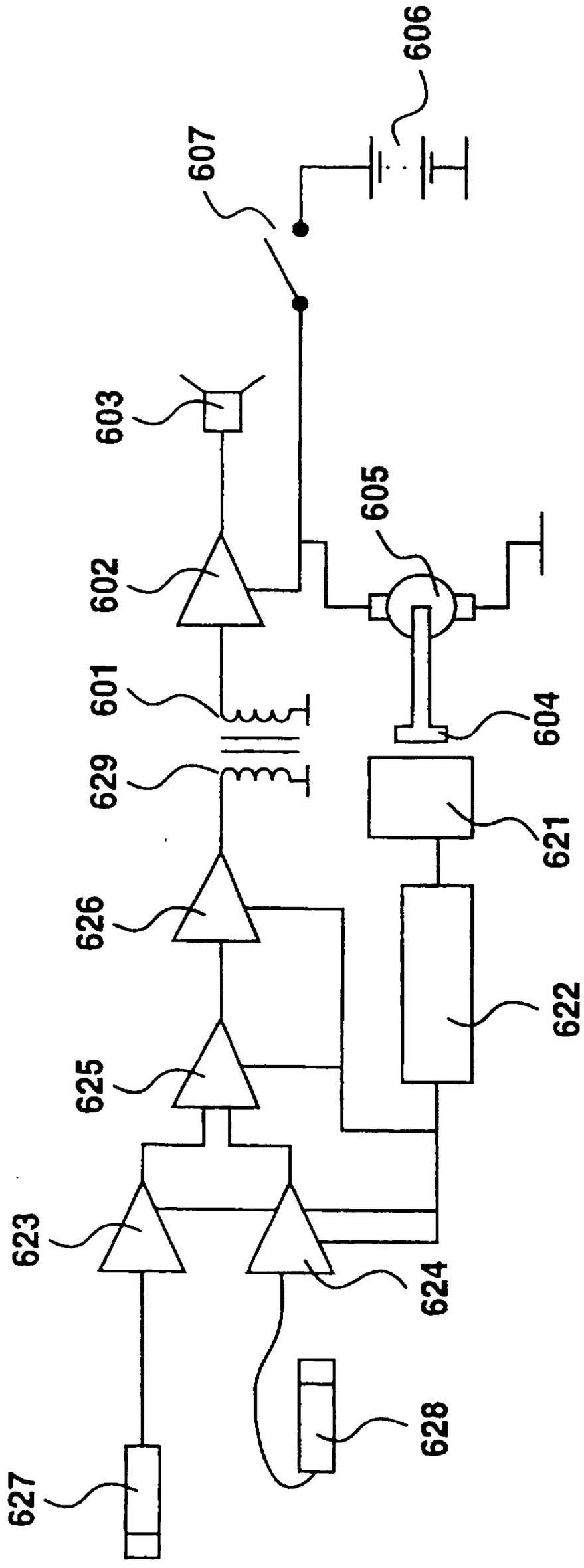


Figure 6

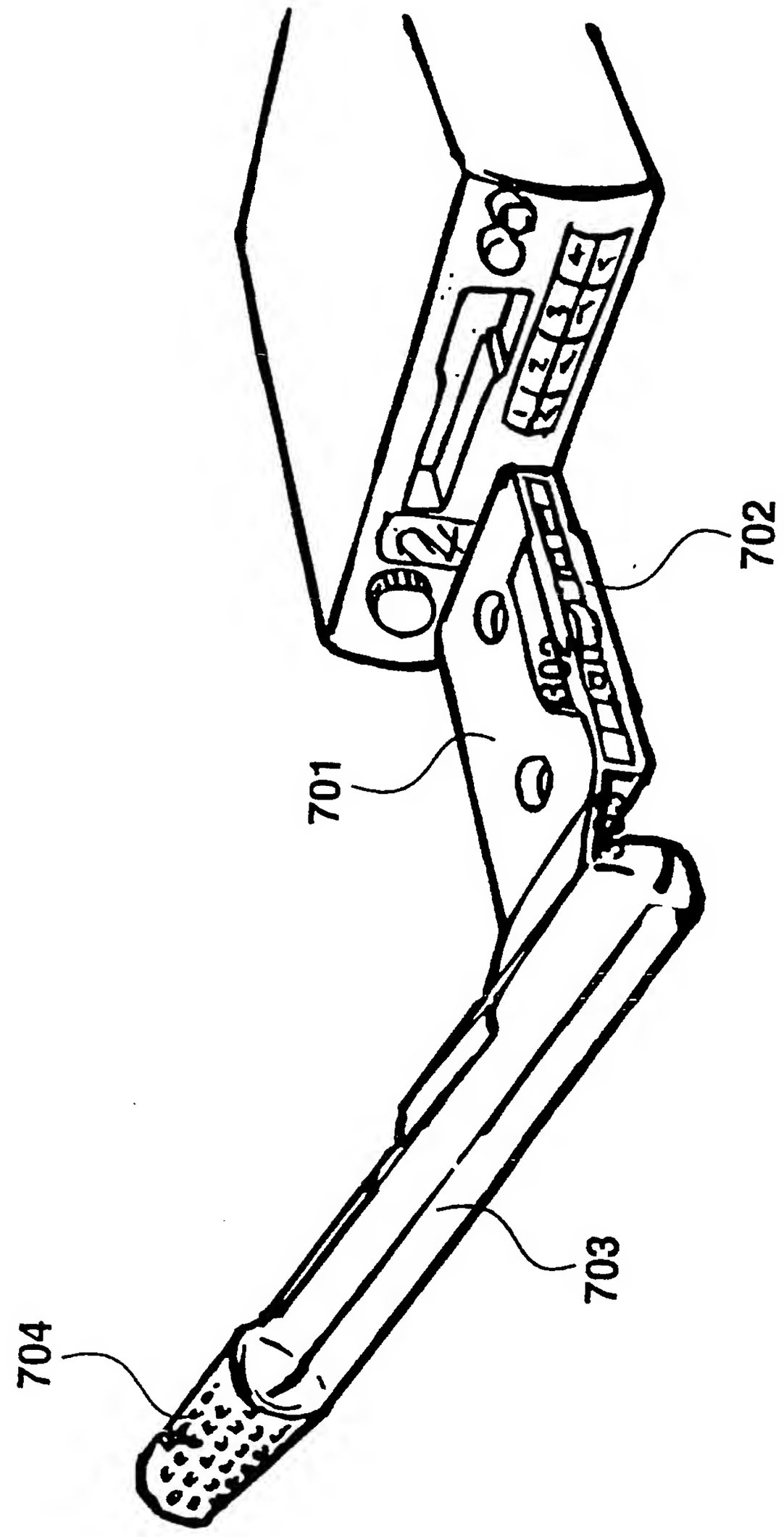


Figure 7

# Adapter Receivable Within a Cassette Player

## Field of the Invention

The present invention relates to an adapter receivable within a cassette player mounted within a motor vehicle, wherein the cassette player is configured to transmit audio signals to loudspeakers.

## Introduction to the Invention

An adapter receivable within a cassette player mounted within a motor vehicle is described in United Kingdom Patent number 2 280 332 B. The cassette player is arranged to transmit audio signals to loudspeakers mounted within the vehicle and comprises a cassette shell arranged to support operational components. The operational components include an amplifier arranged to receive an input signal from a microphone and to convey an output signal to pick-up means, in the form of a magnetic head, forming part of the cassette player. In this way, the adapter is arranged to convey vocalisations from occupants within the vehicle to loudspeakers mounted within the vehicle. In particular, the adapter facilitates vocalisations from front seat occupants being amplified and conveyed to rear loudspeakers within the vehicle such that vocalisations made by said front seat occupants become audible to rear seat occupants.

A problem with the adapter described in the aforesaid British patent is that power required for driving said amplifier is derived from batteries contained within the shell itself. These batteries will tend to discharge at all times including times when the adapter is not actually required and is not in use. Consequently, users are required to change batteries on a frequent basis which may lead to the adapter being unavailable for use when required and, ultimately, may lead to the adapter being discarded, with its facilities being perceived as having relatively little value. This in turn could reduce the

perceived value of the adapter in the market place and consequently lead to a loss of sales.

It is an object of the present invention to provide an improved adapter with improved operational characteristics.

## Summary of the Invention

According to a first aspect of the present invention, there is provided an adapter receivable within a cassette player mounted within a motor vehicle, wherein said cassette player is configured to transmit audio signals to loudspeakers, comprising a cassette shell arranged to support operational components including an interface to said cassette player and amplification means; and a microphone arranged to receive vocalisations from vehicle occupants and to supply audio signals to said amplification means; wherein said operational components include detection means configured to detect a condition to the effect that the adapter has been received within a cassette player and to activate said amplification means in response to said detection.

The adapter provides a substantially longer operational life from enclosed batteries by effectively minimising power loss when the adapter is not in use.

In a preferred embodiment, the adapter is configured to detect that a cassette player has ceased to receive power while the adapter is held within the player and to deactivate said amplification means in response to said detection. Preferably, power removal is detected by detecting the absence of mechanical movement of the cassette player and this mechanical movement may be detected by repeated activation of a switch. Preferably, the switch is magnetically coupled to a moving part. Repeated activation of the switch may cause current to flow via a capacitance such that operational circuitry ceases to operate if said capacitive current ceases to flow.

According to a second aspect of the present invention, there is

provided an adapter receivable within a cassette player mounted within a motor vehicle, wherein said cassette player is arranged to transmit audio signals to speakers mounted in the vehicle, the adapter comprising a cassette shell arranged to support operational components including a microphone fixed to said shell and arranged to receive audio speech from a driver or from a front seat passenger; amplifying means arranged to receive an output signal from said microphone; transmitting means arranged to convey an output signal from said amplifying means to tape pick-up means of a cassette player; and noise cancellation means configured to reduce the noise component of an amplified signal due to mechanical operation within the adapter and the cassette player.

In a preferred embodiment, the noise cancellation means includes a noise cancellation microphone configured to generate signals which are subtracted from an input from the main microphone.

According to a third aspect of the present invention, there is provided an adapter receivable within a cassette player mounted within a motor vehicle, wherein said cassette player is configured to transmit audio signals to loudspeakers, comprising a cassette shell arranged to support operational components including an interface to said cassette player and amplification means; and a microphone arranged to receive vocalisations from vehicle occupants and to supply audio signals to said amplification means; wherein said adapter includes means for simulating the presence of a moving tape to ensure that a co-operating cassette player does not cease to operate.

In a preferred embodiment, the cassette shell includes sprocket wheels and said simulating means is arranged to rotate said sprocket wheels in the same direction. In an alternative embodiment, the cassette shell includes sprocket wheels and said simulating means is arranged to rotate said sprocket wheels at a substantially constant speed. Preferably, said speed is substantially similar to that achieved in a standard magnetic tape

cassette.

According to a fourth aspect of the present invention, there is provided an adapter receivable within a cassette player mounted within a motor vehicle, wherein said cassette player is configured to transmit audio signals to loudspeakers, comprising a cassette shell arranged to support operational components including an interface to said cassette player and amplification means; and a microphone arranged to receive vocalisations from vehicle occupants and to supply audio signals to said amplification means; wherein said adapter includes means for applying a mechanical bias upon an output coil so as to force said output coil into physical contact with the playback heads of a cassette player. Preferably, the adapter also includes spring-loaded means configured to contact with a drive capstan of the cassette player and said spring-loaded means may include a driven wheel arranged to drive sprocket wheels. Preferably, an intermediate drive wheel is mounted between said sprocket wheels and includes magnetic detection means mounted thereon. Preferably, the magnetic detection means is configured to co-operate with a switch, so as to activate said switch in a repeated fashion during mechanical motion.

## Brief Description of the Drawings

*Figure 1* shows a plan view of a motor vehicle ;

*Figure 2* details the dashboard of the motor vehicle shown in *Figure 1*;

*Figure 3* shows an adapter receivable within a cassette player included within the dashboard shown in *Figure 2*;

*Figure 4* shows a cross section of the adapter identified in *Figure 3*;

*Figure 5* details a circuit included within the adapter shown in *Figure 4*; and

*Figure 6* shows a schematic representation of the functionality of the system; and

*Figure 7* shows an alternative embodiment having a larger battery compartment.

**Detailed Description of The Preferred Embodiments**

The invention will now be described by way of example only with reference to the previously identified drawings.

A plan view of a motor vehicle in the form of a standard saloon automobile **101** is shown in *Figure 1*. The vehicle includes a seat **102** for a driver, a seat 103 for a front seat passenger and seats **104** for rear seat passengers.

The driver, along with a front seat passenger and rear seat passengers often engage in conversation while travelling. Given that all of the vehicle occupants are front facing, the driver and the front seat passenger easily hear vocalisations made by the rear seat passengers. However, it is not so easy for rear seat passengers to hear the vocalisations of front seat passengers; a situation made worse if noise is being generated by the vehicle itself. Furthermore, problems of this type may be made worse if a rear seat passenger is hard of hearing. Furthermore, particularly with high speed motorway/autobahn/freeway driving, it is important for the driver not to lose sight of the road conditions therefore the driver should be discouraged from turning around to facilitate communication with rear seat passengers. This could also create a problem if children are being conveyed in the rear seats.

Like many vehicles of this type, the automobile is equipped with an audio system, mounted centrally at position 105. The audio system supplies audio, usually in the form of music, to front loudspeakers **106** and to rear loudspeakers **107**. Audio system **105** includes a radio and a cassette player, configured to receive conventional audio cassettes. In addition, the audio system may include provision for playing compact discs or other audio conveying media. However, it is the provision of a cassette player that is

important, given that it is possible for the magnetic heads within the player to interface with other equipment and thereby allow other audio signals to be transferred to the loudspeakers. Thus, it is known for interfaces to be provided to allow an external compact disc player to be interfaced in this way.

The adapter described in the aforesaid British patent includes a microphone arranged to receive vocalisations from front seat occupants. In addition, an amplifier is included and this is arranged to amplify vocalisations so as to provide appropriate signals, via an interface, to the heads of the cassette player. The audio equipment is configured such that vocalisations made by front seat occupants are amplified and relayed to the rear loudspeakers **107**. Thus, in this way, rear seat occupants can clearly hear vocalisations made by front seat occupants, without requiring additional effort on the part of the front seat occupants, thereby enhancing the ability for conversations to take place within the vehicle without requiring additional effort on the part of the front seat occupants.

A dashboard of a motor vehicle is illustrated in *Figure 2*. The vehicle has conventional controls such as a steering wheel **201** and a gear lever **202**, along with less essential equipment, such as a clock **203**, ventilation system **204** and an audio system **205**. The audio system **205** includes an audio cassette player **207** configured to receive a cassette within a cassette receiving slot **208**. Upon receiving a cassette within slot **208**, the cassette player **207** immediately starts playing the cassette and will continue to do so until a cassette eject button is operated. In this way, a driver or front seat passenger may listen to audio output from cassettes with minimal interaction with the cassette player; primarily in view of safety considerations. Thus, in this respect, a volume control for the audio equipment **205** may be mounted close to steering wheel **201**, allowing a driver to make modifications to the volume level without removing a hand from said steering wheel.

An adapter **301** embodying the present invention is shown in *Figure 3*.

The adapter includes an outer shell, a portion of which **302** has a profile substantially similar to that provided by a conventional audio cassette. In addition, a transmission coil **303** is provided at a position where magnetic tape would normally be made accessible, so as to interface with tape heads of a cassette player, such as player **304** shown in *Figure 3*.

Adapter **301** includes an extended portion **305** which extends from the conventional cassette shell **302** and protrudes out from a cassette player **304** when in operation. The extended portion **305** provides a housing for two 1.5 volt batteries in addition to a microphone **306**. The microphone receives vocalisations from the front seat occupants and audio signals generated by the microphone are amplified by an amplifier contained within shell **302**. Amplified signals are then conveyed to the output coil **303** for further amplification by the cassette player **304**.

Thus, there is provided an adapter receivable within a cassette player mounted within a motor vehicle. The cassette player is configured to transmit audio signals to loudspeakers and the adapter takes a form of a cassette shell arranged to support operational components including an interface to the cassette player and an amplifier. A microphone is connected to the amplifier such that vocalisations received from vehicle occupants, primarily the front seat occupants are supplied to the amplifier which in turn relays these signals to the loudspeaker via the cassette player. The amplifier contained within the adapter is powered by disposable batteries and the adapter is designed so as to minimise power loss from these batteries. Thus, the operational components include a detector configured to detect a condition to the effect that an adapter has been received within a cassette player. Thereafter, when this condition has been detected, the amplifier within the adapter is activated, thereby placing it in an operable condition.

The portion **302** of the adapter **301** having a profile substantially similar to that provided by a conventional audio cassette is shown in cross-

section in *Figure 4*. Transmission coil **303** receives output signals from amplifying circuit **401**, which in turn receives an input from microphone **306** via input leads **402**. Output coil **303** is mounted within a spring-loaded coil housing **403** such that said housing is configured to slide in the directions of arrow **404** such that the coil may be held within the cassette shell by a greater or lesser extent. An outward bias is placed on the coil housing by means of a coil housing spring **405**. Thus, after the cassette shell has been inserted within a tape player, the coil housing slides inwards when it came into contact with the tape heads, whereafter pressure is applied, by means of housing spring **405**, so as to force coil **303** into close proximity with the play-back heads of the tape player. This ensures that a good magnetic linkage is maintained between output coil **303** and co-operating coils within the tape heads of the tape player **304**.

The adapter **301** is shown in a condition as it would be found when in operation, ie when co-operating with a cassette player although much of the mechanics of the cassette player is not shown in the Figure. When co-operating with a tape player, a capstan **406** enters within a capstan hole **407**. In its normal mode of operation, that is to say, when playing cassette tapes the capstan **406** drives the magnetic tape at constant speed by said tape being secured between said capstan and the co-operating pinch wheel. In the adapter shown in *Figure 4*, there is no magnetic tape and the functionality provided by the capstan is effectively redundant. However, a problem occurs in that many tape players are designed to detect conditions relating to the movement of tape and thereafter take appropriate action.

The tape is usually held on sprocket wheels and is wound from one sprocket wheel to the other, usually in both directions to provide two-side audio-play. In the adapter, a first spool **408** is included, along with a second sprocket wheel **409**. These sprocket wheels engage with an intermediate sprocket wheel **410** and the sprocket wheel assembly **408** to **410** is driven

by a grip wheel **411**.

In a conventional cassette, tape is taken from one sprocket wheel and wound upon a second sprocket wheel, resulting in both sprocket wheels rotating in the same direction. Conventionally, the second sprocket wheel is driven by a slip mechanism in an anti-clockwise direction so as to take up tape slack received from capstan **406**. The first sprocket wheel is also rotated in an anti-clockwise direction as tape is removed from it however a slip-drive mechanism attempts to drive the first sprocket wheel in a clockwise direction so as to maintain the tape in a taught condition as it is being driven by the capstan. Consequently, if the tape should break, wheel 408 would be allowed to rotate in a clockwise direction, resulting in the sprocket wheels rotating in opposite directions. Thus, a condition to the effect that the wheels are rotating in opposite directions may be used to detect a tape breakage condition from which appropriate action, usually the switching off of the mechanism, may be taken. Thus, in order for this situation to arise, the wheels are configured so that the first sprocket wheel **408** and the second sprocket wheel **409** are driven in anti-clockwise direction.

It is appreciated that the adapter needs to be operable with many types of tape player. It is therefore known that some tape players detect the speed of rotation of the sprocket wheels so as to identify fault conditions. Thus, it is possible that a slow speed would indicate the presence of a jam while a high speed would indicate a tape breakage condition. Thus, in order to avoid these mechanisms taking effect, the adapter is configured so as to maintain relatively normal operational rotational speeds of the sprocket wheels **408** and **409**.

Grip wheel **411** includes a gripping circumference **412** grippable against capstan **406**. The grip wheel is translatable in the direction of arrow **413** and is pushed in these directions by means of a main lever **414**. A

spring **415** applies a bias to main lever **414**, thereby pushing said lever towards the bottom-left. When the adapter is not retained within a cassette player, coil housing spring **405** forces coil housing **403** outwards and co-operating portion **416** of the coil housing forces main lever **414** towards the top-right, it being noted that the force exerted by spring **405** is greater than that exerted by spring **415**. However, when the adapter is inserted within a cassette player, coil housing **403** is pushed into the shell, thereby allowing main lever **414** to move towards the bottom-left until the gripping circumference **412** contacts against the capstan **406**. Thus, in its operational condition, grip wheel **411** is driven by capstan **406**.

Grip wheel **411** has a coaxial gear wheel **417** and this engages with the second sprocket wheel **409**. Thus, movement of capstan **406** results in clockwise rotation of grip wheel **411** which in turn results in anti-clockwise rotation of second sprocket wheel **409** and anti-clockwise rotation of first sprocket wheel **408**, via the intermediate sprocket wheel **410**.

The rotational speed of grip wheel **411** is such as to maintain a rotational speed of the first and second sprocket wheels **408**, **409** at 0.61 revolutions per second.

A magnet **421** is mounted on the intermediate sprocket wheel **410** and this magnet passes underneath a read switch **422**, resulting in the read switch being pulsed on and off as the magnet passes underneath said switch. Thus, the constant rotation of intermediate sprocket wheel **410** results in the generation of pulses, by the means of read switch **422**, having a substantially constant frequency.

Amplifying circuit **401** is detailed in *Figure 5*. Electrical power is received on power input lines **501**, from batteries contained within extended portion **305**. Leads **502** are connected to glass encapsulated read switch **422** which receives the three volt input supply. When switch **422** is closed, by being in proximity to magnet **421**, capacitor **503** (eighteen micro-farads)

is charged via diode **504** and capacitor **505**, (one micro-farad). Capacitor **503** continues to charge until transistor **506** becomes conductive, resulting in the supply of a constant voltage to the base terminal of transistor **507**, thereby causing transistor **507** to become conductive. The collector terminal of transistor **507** is connected to the negative supply rail (effectively ground) such that when transistor **507** saturates, the ground end of the main circuit is connected to the negative supply rail of the power supply thereby placing supply rail **508** in an operational condition. Input leads **402** from microphone **306** are supplied to a high gain inverting amplifier. The output from the microphone is supplied to the inverting input terminal of an operational amplifier **511** (LM 324) via a coupling capacitor **512** in series with an input resister **513**. The operational amplifier **511** receives bias at its non-inverting input by means of a voltage divider formed by resistor **514** (10 K) in series with resistor **515** (10 K). Thus, the operational amplifier **511** receives half the potential of the power supply at its non-inverting input.

The non-inverting input of the operational amplifier **511** is de-coupled by means of de-coupling capacitor **516** (4.7 micro-farads) and a degree of negative feedback is provided by resistor **517** (1 K). This provides an overall voltage gain of approximately forty dB and the output from this amplification stage is supplied via coupling capacitor **517** (2.7 micro-farads) to a differential amplification stage.

A noise cancellation pre-amplifier is provided by components **531** to **537**, being substantially equivalent to components **511** to **517** described above and arranged in the same topology. The noise cancellation pre-amplifier includes a circuit-mounted microphone, illustrated by capacitor **541**. The purpose of this microphone is to detect mechanical noise generated within the adapter and the surrounding cassette player mechanism. This noise is amplified and then subtracted from the main signal derived from microphone **306** so as to provide a noise cancellation

effect.

Thus, this is achieved by means of the differential amplifier which is configured to amplify the difference between the required signal, detected by microphone **306** and unwanted signals in the form of mechanical noise detected by the noise cancellation microphone. Thus, the signal generated by the noise cancellation microphone is applied to the inverting input of the differential amplifier such that noise is then cancelled from the main audio signal derived from microphone **306**, thereby improving overall system performance.

Operational amplifier **551** (LM 324) is configured as a differential amplifier with resistors **552** (22 K), **553** (22 K), **554** (22 K) and **555** (22 K) providing an input bias. Resistor **556** (100 K) provides negative feedback and the output from operational amplifier **551** is supplied to the non-inverting input of an output driver (configured round a further LM **324** operational amplifier) **557** via a coupling capacitor **558** (2 micro-farads) and an input resistor **559** (10 K).

Operational amplifier **557** is configured as a high to low impedance buffer with unity gain. Bias is provided by resistors **561** (22 K) and **562** (22 K) and the output from this stage is used to drive the output coil **303** via capacitor **563** (47 micro-farads).

When the adapter is in use, such that it has been inserted within a cassette player, output coil **303** and the tape playback head of the cassette player are mechanically and magnetically coupled and thereby effectively create a transformer. Thus, alternating current flowing through the output coil **303** results in the induction of current in the coils of the tape head thereby transferring the audio signal to the cassette deck.

The circuitry shown in *Figure 5* ensures that amplification is provided when this is required in order for the adapter to function. However, if the adapter is removed from the cassette player, the read switch ceases to be

pulsed, resulting in transistor **506** and transistor **507** becoming non-conductive. Similarly, if power is removed from the cassette player itself, by the device being switched off or by the ignition of the motor vehicle being switched off, the capstan drive wheel of the cassette player ceases to rotate resulting in no rotational movement being incurred within the adapter itself. Consequently, again, the read switch ceases to be pulsed and the amplifying components within the circuit cease to receive power.

A schematic representation of the overall system, that is to say the adapter in co-operation with a cassette player, is illustrated in *Figure 6*. A car mounted cassette player includes a magnetic pick-up head **601** which supplies audio signals to an amplifier **602** which in turn drives a loudspeaker within the vehicle **603**. A cassette drive mechanism **604** receives mechanical power from an electric motor **605** and electric motor **605** and amplifier **602** receive power from the vehicle's main battery supply **606** via a switch **607**. Thus, when switch **607** is placed in its closed condition, motor **605** drives the cassette mechanism and power is directed to audio amplifier **602**.

Movement of the cassette mechanism **604** is detected by magnetic coupling **621** and upon this being detected, adapter power supply **622** is activated. When activated in this way, power supply **602** supplies power to input preamplifiers **623** and **624**, differential amplifier **625** and output driver **626**. Main microphone **627** receives vocalisations from front seat occupants, in addition to mechanical noise generated by the adapter and the cassette drive mechanism. Internal microphone **628** is shielded from the external vocalisations but is sensitive to the undesired noise generated by the mechanical mechanisms. These signals are amplified by their respective preamplifier **623** and **624**, whereafter differential amplifier **625** subtracts the unwanted noise signal from the main input signal. This differential signal is then amplified by output driver **626** resulting in an

output current being supplied to output coil **629**. Thus, input coil **601** receives an input which is then amplified by amplifier **602** and supplied to speakers **603**. If the cassette mechanism is switched off, by switch **607** being placed in an open condition, drive motor **605** ceases to operate and the mechanical movement ceases to be detected by detector **621**, resulting in the deactivation of power supply **622**. In this way, power supply **622** is conserved and the operational life of batteries within the adapter is significantly increased.

An alternative embodiment is shown in *Figure 7* in the form of an adapter **701** having a cassette shell portion **702** substantially similar to the cassette shell portion **302** shown in *Figure 3*. However, an extended portion **703** is made significantly larger, thereby allowing batteries of substantially higher capacity to be retained therein. A microphone **704** is shown attached to the battery housing **703** but in an alternative embodiment, microphone **704** may be removed and possibly attached to a driver's lapel for example, with leads extending from the battery **704** back to the adapter.

## Claims

1. An adapter receivable within a cassette player mounted within a motor vehicle, wherein said cassette player is configured to transmit audio signals to loudspeakers, comprising

a cassette shell arranged to support operational components including an interface to said cassette player and amplification means; and

a microphone arranged to receive vocalisations from vehicle occupants and to supply audio signals to said amplification means; wherein

said operational components include detection means configured to detect a condition to the effect that the adapter has been received within a cassette player and to

activate said amplification means in response to said detection.

**2.** An adapter according to claim **1**, configured to detect that a cassette player has ceased to receive power while the adapter is held within said player and to deactivate said amplification means in response to said detection.

**3.** An adapter according to claim **2**, wherein said power removal is detected by detecting the absence of mechanical movement of the cassette player.

**4.** An adapter according to claim **3**, wherein said mechanical movement is detected by repeated activation of a switch.

**5.** An adapter according to claim **4**, wherein said switch is magnetically coupled to a moving part.

**6.** An adapter according to claim **4** or claim **5**, wherein repeated activation of said switch causes current to flow via a capacitance such that operational circuitry ceases to operate if said capacitive current ceases to flow.

**7.** An adapter according to claim **6**, wherein said current flow activates a transistor which in turn provides power to amplification circuitry.

**8.** An adapter according to any of claims **1** to **7**, wherein a microphone is fixed to the cassette shell such that the adapter is configured as a unified construction.

**9.** An adapter according to claim **8**, wherein an additional noise cancellation microphone is provided within the shell and noise signals generated by said cancellation microphone are subtracted from an input from the main microphone.

**10.** An adapter according to any of claims **1** to **9**, including means for securing an internal power source.

**11.** An adapter according to any of claims **1** to **10**, including means for simulating the presence of a moving tape to ensure that a co-operating cassette player does not cease to operate.

**12.** An adapter according to claim **11**, wherein the cassette shell includes sprocket wheels and said simulating means is arranged to rotate said sprocket wheels in the same direction.

**13.** An adapter according to claim **11**, wherein said cassette shell

includes sprocket wheels and said simulating means is arranged to rotate said sprocket wheels at a substantially constant speed.

**14.** An adapter according to claim **13**, wherein said speed is substantially similar to that achieved in a standard magnetic tape cassette.

**15.** An adapter according to any of claims **1** to **14**, wherein mechanical bias is applied to force an output coil into physical contact with playback heads of the cassette player.

**16.** An adapter according to any of claims **1** to **15**, including spring-loaded means configured to contact with a drive capstan of the cassette player.

**17.** An adapter according to claim **16**, wherein said spring-loaded means includes a driven wheel arranged to drive sprocket wheels.

**18.** An adapter according to claim **17**, wherein an intermediate drive wheel is mounted between said sprocket wheels and includes magnetic detection means mounted thereon.

**19.** An adapter according to claim **18**, wherein said magnetic detection means is configured to co-operate with a switch, so as to activate said switch in a repeated fashion during mechanical motion.

**20.** An adapter substantially as herein described with reference to *Figures 3*, *4*, *5* and *6*.

The Patent Office

INVESTOR IN PEOPLE

**Application No:** GB 9819927.6
**Claims searched:** 1 to 19

**Examiner:** Elizabeth Rolfe
**Date of search:** 11 December 1998

# Patents Act 1977
# Search Report under Section 17

**Databases searched:**

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:

UK Cl (Ed.P): G5R (RGA, RAC, RAD); H4J (JA, JGX, JL)

Int Cl (Ed.6): G11B 23/04, 31/00; H04B 1/38; H04M 1/00; H04R 5/04, 5/027

Other: WPI, JAPIO

**Documents considered to be relevant:**

| Category | Identity of document and relevant passage | | Relevant to claims |
|---|---|---|---|
| Y | GB 2280332 A | (TOOLEY) | 1, 8 |
| Y | EP 0223529 A2 | (RECOTON) | 1, 11 - 16 |
| Y | US 5307326 A | (OSAWA) | 1-3, 12-14 |
| Y | US 4034164 A | (WESTMOLAND) | 1, 10, 15 |
| Y | US 3978524 A | (GORDON) | 1, 15 |
| X | US 3946156 A | (BUDROSE) | 1, 2, 15, 16 |

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|---|---|---|---|
| X | Document indicating lack of novelty or inventive step | A | Document indicating technological background and/or state of the art. |
| Y | Document indicating lack of inventive step if combined with one or more other documents of same category. | P | Document published on or after the declared priority date but before the filing date of this invention. |
| & | Member of the same patent family | E | Patent document published on or after, but with priority date earlier than, the filing date of this application. |